

Comparative Rates of Predation on Northern and Southern Periwinkles

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Previous work has shown that predation by crushing predators is often more intense on tropical gastropods (snails) than on their northern counterparts (Vermeij, 1976). P. V. Hamilton (1976) has shown that *Callinectes sapidus* is an important predator on the periwinkle *Littorina irrorata*. Being interested in work done concerning the predation on temperate and tropical gastropods, we took the opportunity to examine specific cases. In this paper we discuss the relative rates of predation on two populations of periwinkles, *Littorina irrorata*, from a Florida saltmarsh, and *Littorina littorea* from a Massachusetts salt marsh.

The class collected 240 *Littorina littorea* from Little Sippiwisset Marsh, Woods Hole, Mass., and 235 living *L. irrorata* were sent from the marsh at Florida State University Marine Laboratory, Sopchoppy, Florida. Groups of investigators measured each shell using Vernier calipers, and recorded repaired injuries on the body whorl. Injuries were recognized as jagged, irregular scars not easily confused with growth lines. Any disagreements arising about the number of injuries were resolved by using a dissecting microscope.

The results of this experiment were as follows: On the 235 shells of *L. irrorata* we recorded 192 injuries. The 240 shells of *L. littorea* had 96 injuries; that is, exactly a 2:1 ratio occurred. The Chi-square test showed that the probability that this happened by chance was $< .005$.

After observing the preceding results, we have formulated three hypotheses to explain them; these are discussed in order of highest to lowest probability. An experiment which could be used to test these hypotheses will be presented later.

Our first hypothesis is that the southern predators are stronger than the northern ones. A stronger *Callinectes sapidus* (blue crab), for example, would be more successful in any given attack. This idea seems to be in agreement with those of other researchers (Vermeij, 1976).

A second hypothesis is that the northern periwinkle, which is more spherical and with a lower spire than the southern periwinkle, would be harder to grasp, and would thus elude a greater number of attacks. This hypothesis also agrees with previous work (Zipser and Vermeij, 1978).

Our last hypothesis is that the number of southern blue crabs or other predators could be greater than the number of northern ones, in our localities. This would allow more frequent attacks on each individual southern *Littorina*.

An experiment to help test these various hypotheses would be to collect both species of periwinkles, and both northern and southern blue crabs, and to put them in four separate tanks. The first would have a northern crab and northern periwinkles, the second a northern crab and southern periwinkles, the third a southern crab and northern periwinkles, and the fourth a southern crab and southern periwinkles. These would be observed for differences and similarities in the rates of predation.

¹ Bettina Dudley, teacher; Denise Mauzeraell and Chris Cousins, assistants.

References Cited

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Six New North American Species of *Melanagromyza* Hendel (Diptera, Agromyzidae)

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ABSTRACT

The following new species are described: *Melanagromyza hicksi* (Ontario; host, *Alcea rosea* L., Malvaceae), *M. lomatii* (Oregon; host, *Lomatium nudicaule* [Pursh] C. & R., Apiaceae), *M. panacis* (Indiana; host, *Panax quinquefolius* L., Araliaceae), *M. radicolica* (Maryland; host, presumably *Urtica dioica* L., Urticaceae), *M. vernoniae* (Maryland; host, *Vernonia noveboracensis* [L.] Michx.), and *M. vernoniana* (Maryland; host, *V. noveboracensis* [L.] Michx.). The latter two species were reared from the same plant in the same locality. Male postabdominal characters of *M. angelicae* (Frost) are figured for the first time for comparison with those of *M. hicksi*.

The descriptions here presented are part of the author's cooperation with Kenneth A. Spencer in the preparation of a manual of the Agromyzidae of the United States, and the species are described here in order to provide more complete description than would be proper to the Manual.

As with most species of *Melanagromyza*, the most distinctive characters are found in the male postabdomen (terminalia). Relationships will be brought out in the keys to be presented in the Manual, although the closest apparent relatives of each species are cited here. All species described herein belong to the major group of North American *Melanagromyza*, with wing vein C extending to M_{1+2} and with only 2 pairs of dorsocentral bristles, both postsutural.

Melanagromyza hicksi Steyskal, new species

(Figs. 1-3)

? "*Anthomyza*" *angelicae* Frost, Hansberry, 1940: 199.
Melanagromyza sp. (Steyskal), Spencer, 1969: 78.

Male. Length of wing 3.0 to 3.2 mm.

Head as in Fig. 2; front matt black, at level of hindmost fronto-orbital bristle 0.43 to 0.46 of total head width (= head 2.12 to 2.22 times as wide as front); frontal orbits rather dull, sloping upward from eye margin, somewhat broadened anteriorly, with 4 or 5 lower inclinate bristles and numerous, rather irregularly disposed setulae, the lowermost proclinate; gena 0.18 of eye-height; antennae narrowly separated by low median keel; arista finely pubescent, 0.57 mm long; eye with sparse, short hairs in upper part.

Mesonotum metallic dark bluish black, shining laterally, dull mesally with minute, rather dense rugulosity; dorsocentral bristles 2, strong, anterior one slightly posterad of level of supra-alar bristle; acrostichal setulae in approximately 8 rows, a few extending posteriorly to scutellar suture.

Wing as in Fig. 3; last section of vein M_{3+4} 0.8 length of penultimate section; squamae and fringes whitish; halter with knob wholly black.

Foretibia without median bristle; midtibia with 2 median bristles, each shorter than tibial diameter.

Abdomen metallic greenish black; postabdomen as in Fig. 1; aedeagus with rounded subbasal swelling on anterior side, gap between U-shaped basiphallus and distiphallal complex about 0.6 length of latter; epanthrium (Fig. 1D) in profile with ventral margin moderately but sharply offset at about 0.4 of distance from anterior margin.